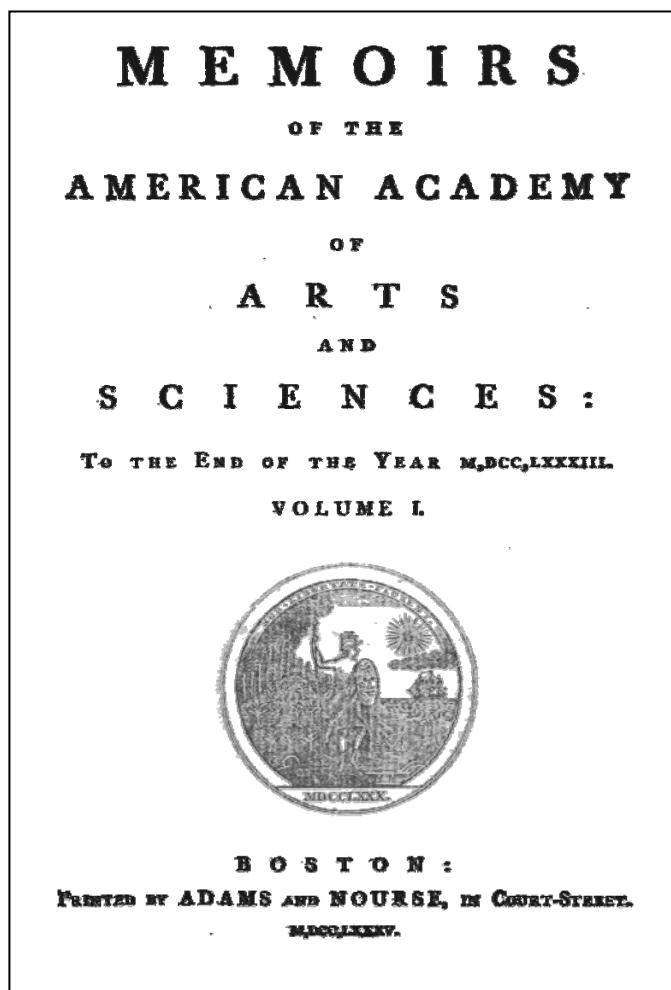


Сообщение о необычной темноте в штатах Новой Англии, 19 мая, 1780.

Самуэль Уильямс,

Заведующий кафедрой,
профессор математики и философии университета в Кембридже.
Мемуары Американской академии наук и искусств.

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Бостон

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Перевод на русский язык и оформление.

**2016
М. Теппоне,
"Истина сделает вас свободными"**

Сообщение о необычной темноте в штатах Новой Англии, 19 мая, 1780.

Самуэль Уильямс, Заведующий кафедрой,
профессор математики и философии университета в Кембридже.
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Наилучший способ продвижения знаний и науки о природе, это наблюдения и проведение эксперимента. Для определения общего смысла и законов природы, им должно быть уделено тщательное и постоянное внимание; и когда происходят какие-то новые явления, то следует собрать все детали обстоятельства, а также их последствия. Таким образом, мы, скорее всего, сможем узнать что-то новое относительно их причин; или, по крайней мере, мы должны подготовить материалы, которые помогут нашему потомству разобраться в том, что в настоящее время остается для нас загадкой.

"The best method to promote the knowledge and science of nature, is to proceed by way of observation and experiment. The general course, productions, and laws of nature, should be carefully and steadily attended to: and when any new phenomena appear, all the circumstances and effects, relating to them, mould be particularly noted and collected. In this way we shall be most likely to arrive at the knowledge of their causes: or, at least, we shall prepare those materials which may enable posterity to determine, with certainty and precision, on what at present may be but imperfectly understood.

Исходя из этой предпосылки, я постараюсь изложить перед обществом подробности, собранные мною относительно необычной темноты, имевшей место в Штатах Новой Англии.

With this view, I shall endeavour to lay before the Society, as particular an account as I can collect, of the uncommon darkness which took place in the states of *New-England*.

"Необычная темнота" наблюдалась 19-го мая 1780 года. Это явление началось между 10 и 11 часами утра, и продолжалось до середины следующей ночи, с некоторыми различиями в отдельных местах. Предположительно, 'темнота' вначале появилась на юго-западе, откуда дул ветер, и откуда появились облака. В различных местах 'темнота' отличалась по своей интенсивности. В большинстве мест темнота была настолько выраженной, что без использования зажженных свечей было невозможно читать газеты и книги, определять время по часам {234}, обедать и совершать другие обычные действия. В отдельных местах из-за 'темноты' было невозможно читать на открытом воздухе в течение нескольких часов, но это имело место лишь на ограниченной территории. По сообщению очевидцев, распространенность 'темноты',

была довольно внушительной, и охватывала всю территорию Новой Англии (New-England): от Фалмут (*Falmouth*) на востоке, до штата Коннектикут (*Connecticut*), и до Албании (*Albany*) на западе. От побережья на юге, до наиболее северных обитаемых территорий. Возможно, на каких-то направлениях 'темнота' распространилась дальше, но об этом нет никаких подтверждений. Продолжительность 'темноты' достигала, по крайней мере, 14 часов, но варьировалась в различных местах. Во время темноты, в домах были зажжены свечи; птицы, исполнив свои вечерние песни, улетели к себе на ночлег, а куры вернулись на насест; вокруг кричали петухи, как будто бы провожая уходящий день; * даже на небольшом расстоянии было трудно различать отдельные объекты; и каждая вещь несла отпечаток мрака ночи.

"The time of this extraordinary darkness, was May 19, 1780. It came on between the hours of ten and eleven, A. M. and continued until the middle of the next night; but with different appearances at different places. As to the manner of its approach it seemed to appear first of all in the S. W. The wind came from that quarter, and the darkness appeared to come on with the clouds that came in that direction. The degree, to which the darkness arose, was different in different places. In most parts of the country it was so great, that people were unable to read common print – determine the time of day by their {234} clocks or watches – dine – or manage their domestic business, without the light of candles. In some places, the darkness was so great, that persons could not fee to read common print in the open air, for several hours together: but I believe this was not generally the case. The extent of this darkness was very remarkable. Our intelligence, in this respect, is not so particular as I could wish: but from the accounts that have been received, it seems to have extended all over the *New-England* states. It was observed as far east as *Falmouth*. – To the westward, we hear of its reaching to the furthest parts of *Connecticut*, and *Albany* – To the southward, it was observed all along the sea-coasts: – and to the north, as far as our settlements extend. It is probable it extended much beyond these limits, in some directions: but the exact boundaries cannot be ascertained by any observations that I have been able to collect. With regard to its duration, it continued in this place at least fourteen hours: but it is probable this was not exactly the same in different parts of the country. The appearance and effects were such as tended to make the prospect extremely dull and gloomy. Candles were lighted up in the houses; – the birds having sung their evening songs, disappeared, and became silent; – the fowls retired to roost; – the cocks were crowing all around, as at break of day; – objects could not be distinguished but at a very little distance; and every thing bore the appearance and gloom of night.

Такая общая характеристика наблюдавшегося явления была представлена на первых страницах отчета профессора Уильямса. Далее он дает детальное описание отдельных фактов, обнаруженных им и другими очевидцами {235}.

Such were the general appearances or phenomena of this extraordinary darkness. I shall now mention such particular observations as I have been able to collect, which were either made on this phenomenon, or seem to relate to it {235}.

Что касается состояния атмосферы, предшествующей этой необычной тьме, то в течение нескольких дней воздух был насыщен испарениями и дымом. Солнце и луна имели удивительно красный цвет, а их внешний вид был лишен яркости и ясности. Этот эффект усиливался по мере распространения задымленной атмосферы ближе к горизонту. Необычный феномен был отмечен за 4-5 дней до 19-го мая, и наблю-

* В оригинале используется выражение "as at break of day", переводимое, "как на рассвете".

дался почти на всей территории Новой Англии. Направление ветра было несколько изменчивым, тем не менее, основное направление было с юго-запада и с северо-востока. Температура варьировала от 40 до 55 градусов (по Фаренгейту).^{*} Показатели барометра для данной территории были относительно повышенными, от 29 дюймов и 80 сотых, до 30 дюймов, 50 сотых ртутного столба. Для данного времени года, погода была ясной и прохладной.

With regard to the state of the atmosphere preceding this uncommon darkness, it was universally observed for several days before, that the air appeared to be full of smoke and vapour. The sun and the moon appeared remarkably red in their colour, and divested of their brightness and lucid appearance: and this, obscuration increased as they approached nearer to the horizon. This was observed to be the case in almost all parts of the *New England* states, for four or five days proceeding the 19th of May. The winds had been variable; but chiefly from the S. W. and N. E. The thermometer from 40° to 55°. The barometer rather high for this part of *America*, – from 29 inches 80, to 30 inches 50. The weather had been fair and cool for the season.

Что касается состояния атмосферы, то при появлении темноты было заметно, что на протяжении всего дня давление постепенно снижалось. Это заключенное сделано из наблюдений, проведенных преподобным профессором Вигглсвортом (Wigglesworth), и господином Ганеттом (Gannett). В 12 часов дня столбик ртути в барометре стояла на отметке 29 дюймов, 70 сотых. В 12 часов 30 минут ртутный столбик опустился на 1/100 дюйма. В 1 ч дня он находился на уровне 29 дюймов 67. В 3 часа – на отметке 29 дюймов 65. В 8 часов 8 минут – на уровне 29 дюймов, 64 сотых. В то же время я вел аналогичные барометрические наблюдения в другой части штата. Тогда я был в Бредфорде (Bradford), около тридцати миль к северу от этого места, примерно на том же меридиане, точнее, немного на восток. В 6 часов утра я нашел столбик ртути в барометре на уровне 29 дюймов, 82 сотых. Когда появились признаки потемнения атмосферы, я проверил барометр, и нашел давление на прежнем уровне, равном 29 дюймов, 68 сотых ртутного столба: это было в 10 часов 20 минут. К 10 ч 45 минутам тьма в этой части штата усилилась до наивысшей степени, а столбик ртути снизился до 29 дюймов 67 {236}. Тьма продолжалась на том же уровне в течение полутора часа. В 12 ч 15 м, столбик ртути упал до 29 дюймов 65; а через несколько минут после этого, мрак начал рассеиваться. Высота ртутного столба оставалась на прежнем уровне до вечера без каких-либо значительных изменений. В 8 ч 30 мин, казалось, что произошло небольшое падение давления, но это изменение было настолько мало, что не имело существенного значения; и я не припоминаю, чтобы оно снижалось еще за время наблюдения до 11 часов 30 минут вечера.

As to the state of the atmosphere when the darkness came on, it was observable, that the weight or gravity of it was gradually decreasing the bigger part of the day. This may be inferred from the observations that were made in this place by the Rev. Professor Wigglesworth, and Mr. Gannett. At 12^h they found the mercury in the barometer stood at 29

* 4,5-12,7 ° С. Среднесуточная температура на территории Новой Англии в мае: + 56 °F, или + 13 °C.

inches 70. At 12^h 30', the mercury had fallen the 1/100 part of an inch. At 1^h it was at 29 inches 67. At 3^h it was at 29 inches 65. At 8^h 8' it was at 29 inches 64. I made a course of barometrical observations similar to these, at the same time, in a different part of the state. I was then at Bradford, about thirty miles north of this place, nearly under the same meridian, or rather a little to the east. At 6^h - A.M. I found the mercury in the barometer 29 inches 82. As soon as the darkness began to appear uncommon, I observed the barometer again and found the mercury at 29 inches 68: this was at 10^h 20'. At 10^h 45' the darkness arose, to its greatest degree in that part of the country; and the mercury was then at 29 inches 67. The {237} darkness continued in the same degree for an hour and an half. At 12^h 15', the mercury had risen to 29 inches 65; and in a few minutes after this the darkness began to abate. The mercury remained in this state until evening, without any sensible alteration. At 8^h 30', it seemed to have fallen a little; but so small was the alteration, that it was attended with some uncertainty; nor could I perceive that it stood any lower at 1^h 30'.

Оба барометра представляют собой очень хорошие инструменты. Тот, что использовался здесь, был изготовлены мастером Чампней (Champney): тот, которым пользовался я, был сделан мастером Найрне (Nairne); их работа характеризуется высокой точностью, что обусловлено высоким качеством изготовления. Для большей точности хочу отметить, что дом, в котором я проводил наблюдение, находился, по меньшей мере, на сорок или пятьдесят футов выше той отметки, на уровне которой проводились другие измерения.

Both these barometers appear to be very good instruments. That used in this place was made by *Champney*: that which used was made by *Nairne*: and they may both be depended on as to the accuracy of their construction. It may, however, be proper to observe, that the house where I made my observations, stood at least forty or fifty feet higher than that in which she observations were made here.

Из результатов наблюдений становится ясно, что, когда наступила тьма, вес или тяжесть атмосферы постепенно снижалась в течение всего дня [сноска].*

And from these observations it is certain, that on the day when the darkness took place, the weight or gravity of the atmosphere was gradually decreasing through the whole day.[†]

В тот день цвет объектов был также изменен, о чем необходимо сказать дополнительно. Об этом говорилось в заметках, сделанных местным джентльменом: "Цвет облаков был смешанным, слегка красноватым, желтым и бурый; в темноте, предметы, которые обычно имеют зеленый цвет, были темно зеленого цвета, граничащего с синим; те предметы, которые обычно воспринимаются как белые, были окрашены в желтый цвет". Такие же наблюдение были сделаны и другими очевидцами. Как мне казалось, почти в каждом предмете было преобладание желтого оттенка, по сравнению с какими-либо другими {237} цветами. Это относилось ко всем предметам, не зависимо от того, находились ли они рядом или на удалении от глаз.

The colour of objects that day, was also worthy of remark. It is mentioned, in the observations made by the gentlemen here, that "the complexion of the clouds was compounded of a faint red, yellow, and brown: and that, during the darkness, objects which commonly appear green, were of the deepest green, verging to blue; and that those which appear white, were highly tinged with yellow." Much the same observation was pretty generally made. Almost every object appeared to me to be tinged with yellow rather than with any {237} other colour. This I found to be the case with every thing I held up to view, whether near, or remote from the eye.

* Сноска: Температура по Фаренгейту, в Бредфорде, в 6 часов утра, была 39 градусов, в 12 дня - °51.

В 9 вечера - °46. В Кембриджи, в 12 дня - °51 и ½. В 3 часа дня температура была °51 по Фаренгейту

† *Farenheit's thermometer*, at Bradford, at 6^h A.M. was at 39°. At 12^h it stood at 51°. At 9^h P.M. it was at 46°. – At Cambridge, at 51 ½°. At 3^h P.M. it stood at 51°.

Нашего особого внимания заслуживает характер и внешний вид испарений, которые тогда были в атмосфере. Рано утром, погода была облачной: солнце взошло, но его едва ли можно было разглядеть сквозь облака, и оно имело темно-красный цвет, как это уже было в течение несколько дней. Во многих местах утром можно было услышать звуки грома. С юго-западной стороны приближались тучи вместе с ощущавшимся легким ветром; до восьми часов утра несколько раз прошел дождь, а в некоторых местах дожди были и в другое время дня. Выпавшая дождевая вода была необычной по виду, довольно вязкой, темной и закопченной. Один джентльмен, который тогда был в Ипсвиче (Ipswich), писал, что "он обнаружил, что людей сильно удивил странный вид и запах дождевой воды, которую они собирали в кадках. Изучив воду, я нашел (говорит он), что на ее поверхности было небольшое количество пены и грязи. При ее растирании между большим и указательным пальцем, я нашел, что в ней был черный пепел от сожженных листьев. Вода имела сильный запах копоти, которую мы отмечали в воздухе". Тоже самое наблюдалось и во многих других местах, особенно на реке Мерримак (Merrimack-River), где в тот день было обнаружено большое количество грязи, и черного пепла, плавающих на поверхности воды. Ночью ветер подул с северо-востока и погнал пепел в сторону Южного берега. Когда вода спала, черная грязь лежала вдоль берега на ширине четырех-пяти сантиметров. Я обнаружил это на протяжении пяти или шести миль; – и, наверное, это было во многих других местах. Я изучил большое количество этого вещества; вкус, цвет и запах соответствовал тому, что описал джентльмен в Ипсвиче {238}, – это был черный пепел жженых листьев без каких-либо сернистых примесей.*

Another thing that deserves our attention is, the nature and appearance of the vapours that were then in the atmosphere. Early in the morning, the weather was cloudy: the sun was but just visible through the clouds, and appeared of a deep red, as it had for several days before. In most places thunder was heard several time in the morning. The clouds soon began to rise from the S. W. with a gentle breeze; and there were several small showers before eight o'clock: and in some places there were showers at other times, throughout the day. The water that fell was found to have an uncommon appearance, being thick, dark and sooty. A gentleman, who was then at Ipswich, observes, that "he found the people much surprised with the strange appearance and smell of the rain-water which they had saved in tubs. Upon examining the water, I found (says he) a light scum over it, which rubbing between my thumb and finger, I found to be nothing but the black ashes of burnt leaves: the water gave the same strong sooty smell which we had observed in the air." The same appearance was observed in many other places: and it was very remarkable on Merrimack-River. Large quantities of scum, or black ashes, were found floating upon the surface of the water, that day. In the night, the wind veered round to the N. E. and drove it towards the south shore. When the tide fell, it lay along the shore at the width of four or five inches. This I found to be the case for five or six miles; – and probably it was the case for many more. I examined a considerable quantity of this matter; and in taste, colour and smell, it very plainly appeared to be nothing more than what the gentleman observed at Ipswich, {238} – the black ashes of burnt leaves, without any sulphureous, or other mixtures.[†]

Опасаясь каких-либо необычных веществ в воздухе, я в тот день раскладывал несколько специальных листов чистой бумаги во время дождя и без него. После экспо-

* То же самое наблюдалось в Конкорде и Дувре в Нью-Гэмпшире (New-Hampshire), а также в Бервике (Berwick), и многих других местах этого штата.

[†] The same was observed at Concord and Dover in New-Hampshire; at Berwick, and many other places in this state.

зиции их под открытым небом в течение четырех или пяти часов, я сушил их у костра. Они были пропитаны чем-то темным; и было ощущение, что их натерли маслом или каким-то жиром. Но при их горении не было запаха сернистых или азотистых частиц.

Being apprehensive whether there was not some uncommon matter in the air that day, I put out several meets of clean paper in the air and rain. When they had been out four or five hours, I dried them by the fire. They were much sullied, and became dark in their colour; and felt as if they had been rubbed with oil or grease. But upon burning them, there was not any appearance of sulphureous or nitrous particles.

Движение и нахождение испарений в атмосфере заслуживают особого внимания. В большинстве мест было заметно, что пары опускались с верхней части атмосферы ближе к поверхности земли. Джентльмен, который тогда был в Пепперрелли (Perrerrell),^{*} описал свое очень любопытное наблюдение за перемещением пара. "Около девяти часов утра (говорит он), после дождя, пар в большом изобилии поднимался от источников, находящихся в низинах. Над самыми высокими холмами я заметил один большой столб пара, который быстро поднимался на значительную высоту, и превращался в одно большое облако; затем облако начало движение на запад. Второе облако было сформировано таким же образом, из тех же самых источников, но оно уже не поднялся так высоко, как первое, а третье тоже было сформировано таким же образом менее чем через четверть часа после второго. При мерно в три четверти часа после девяти, эти тучи представляли собой очень романтический вид. Верхние облака казались красноватого цвета, средние, {239} находясь там же, были зелеными в одних местах, и синими, цвета индиго, в других; третье облако, появившееся позже, было почти белым". Один из джентльменов, который наблюдал это явление, вспоминает обстоятельство исключительно интересного характера. – "В то время, когда тьма продолжалась (говорит он), тучи находились в постоянном и быстром движении, они прерывались и обгоняли друг друга; как я полагаю, произошло формирование значительного количества слоев: нижний слой в пределах видимости находился на одной и той же высоте, - и эта высота была достаточно малой, близкой к видимому горизонту, и такое состояние наблюдалось в течении всего вечернего времени. Я был на улице, и видел человека с зажженной лампой, а также отраженный свет слегка красноватого цвета, похожий на слабое сияние (*Aurora Borealis*), которое находилось на небольшой высоте над моей головой. Высота, на которой был виден отражение света, не превышала двадцати - тридцати футов". – Вообще было заметно, что возвышение холмов в различных направлениях можно было увидеть на расстоянии, а промежуточное пространство было в значительной степени скрыто темнотой.

* Господин Имс (Eames), преподаватель из университета.

The motion and situation of the vapours in the atmosphere, was also worthy of notice. In most places it was very evident that the vapours were descending from the higher parts of the atmosphere towards the surface of the earth. A gentleman, who was then at Pepperrell,* mentions a very curious observation, as to their ascent and situation. "About nine o'clock (says he) in the morning, after a mower, the vapours rose from the springs in the low lands, in great abundance. I took notice of one large column that ascended with great rapidity, to a considerable height above the highest hills, and soon spread into a large cloud; then moved off a little to the westward. A second cloud was formed in the same manner, from the same springs, but did not ascend so high as the first: and a third was formed from the same places, in less than a quarter of an hour after the second. About three quarters of an hour after nine o'clock, these clouds exhibited a very romantic appearance. The upper cloud appeared of a reddish colour: the second {239} appeared, in some places, green in others, blue; and in others of an indigo colour: the third cloud appeared almost white." One of the gentlemen, who observed here, mentions a circumstance of somewhat a singular nature. – "While the darkness continued (says he) the clouds were in quick motion, interrupted, skirted one over another; so as apparently, and I suppose, really, to form a considerable number of strata: the lower stratum of an uniform height as far as visible; – that height conceived to be very small from the small extent of the visible horizon, and from this circumstance observed in the evening: – Being in the street, I saw a person with a lighted torch, which occasioned a reflection of a faint red light, similar to a saint Aurora Borealis, at a small height above my head. The height, at which the reflection appeared to be made, was not more than from twenty to thirty feet." – And it was generally remarked, that the hills might be seen at a distance in some directions, while the intermediate spaces were greatly obscured and darkened.

Из этих наблюдений видно, что испарения, лишь в некоторых местах имели восходящее направление; а в большинстве случаев, они опускались вниз; и находились очень близко к поверхности земли. К этому мы можем добавить, что в темноте казалось, что предметы отбрасывали тень во всех направлениях. Во многих местах, было необычное свечение в атмосфере, похожее на северное сияние, и я не видел ничего необычного в электрических разрядах, наблюдавшихся в этот день.[†] {240}

From these observations, it seems as if the vapours, in some places, were ascending; in most, descending; and in all, very near to the surface of the earth. To this we may add, that during the darkness, objects appeared to cast a shade in every direction: and that, in many places, there were several appearances or coruscations in the atmosphere, not unlike the Aurora Borealis: but I do not find that there were any uncommon appearances of the electric fire any where observed that day.[‡] {240}

После описания самого явления и отдельных деталей, которые мне удалось собрать, я постараюсь уточнить причину этого необычного явления.

Having mentioned the phenomena, with such observations upon them, as I have been able to collect, I shall now endeavour to account for the cause of this unusual appearance.

Из наблюдений, которые были сделаны, можно сделать вывод со значительной степенью уверенности, что 19 мая атмосфера была перенасыщена испарениями. Было видно большое количество дыма и паров, которые накапливались в атмосфере в течение нескольких дней до того, и их концентрация была настолько высокой, что это привело к затмению солнца и луны, и в результате чего все предметы на расстоянии казались размытыми и нечеткими. Это также было понятно исходя из выпавших дождевых осадков, содержащих большое количество сажи или черного

* Mr. Eames, a Tutor in the University.

[†] В нескольких отчетах было отмечено, что были найдены тела нескольких мелких птиц, задохнувшихся от испарений". Мертвые птицы были найдены в некоторых новых городах, как вокруг домов, так и в самих домах, как рассказывают очевидцы". - Извлечение из письма из Дувра, Нью-Хэмпшир.

[‡] In several accounts it was also mentioned, that a number of small birds were found suffocated by the vapour. "A number were found dead in several of the new towns, round the houses; and some flew into the houses, as I have been told by eyewitnesses." Extract of a letter from Dover, in New-Hampshire.

пепла, которые были обнаружены на большой территории, на земле, а также плавающими на поверхности воды. Причину появления большого количества этих испарений установить довольно легко. Известно, что в этой части Америки подобное встречается довольно часто, когда с помощью огня выжигаются леса, с целью расчистки земли для новых поселений. Так было и этой весной, но в гораздо большей степени, чем обычно. В графстве Йорк, в западной части штата Нью-Гэмпшир, и в Вермонте, обширные пожары были постоянно. На новых поселениях и в городах, люди таким образом очищали свои земли. Около двух или трех недель до этого, на протяжении нескольких дней, там бушевали обширные лесные пожары. Кроме того, возникали естественные испарения, которые имеются повсеместно, и количество пара увеличивается во время крупных и многочисленных пожаров, которые наблюдались вокруг наших границ. Поскольку погода была ясной, {241} воздух тяжелый, а ветер слабый и переменчивый, то испарения, вместо того чтобы рассеяться, наоборот скапливались и насыщали воздух до тех пор, пока атмосфера стала весьма напряженной с необычно высоким их содержанием.

From the observations that have been mentioned, we may conclude with much certainty, that the atmosphere, on the 19th of May, was charged with an uncommon quantity of vapour. That this was the case, is evident from the large quantity of smoke and vapour that appeared in the atmosphere for several days before; which was so great, as to darken the sun and moon, and render all objects, at a distance, of a dull and very hazy appearance. It was also evident, from the descent of those large quantities of soot, or black ashes, which, through a long extent of country, were found mingled with the rain that fell, and floating on the surface of the waters. And the cause from whence the uncommon quantity of these vapours was derived, is easily ascertained. It is well known, that in this part of America, it is customary to make large fires in the woods, for the purpose of clearing the lands in the new settlements. This was the case this spring, in a much greater degree than is common. In the county of York, in the western parts of the state of New-Hampshire, in the western parts of this state, and in Vermont, uncommonly large and extensive fires had been kept up. The people in the new towns had been employed in clearing up their lands this way, for two or three weeks before: and some large and extensive fires had raged in the woods for several days before they could be extinguished. In addition, there fore, to what arises from evaporation, and those exhalations which are constant and natural, a much larger quantity of vapour arose from those large and numerous fires, which extended all around our frontiers. As the weather had been clear, the {241} air heavy, and the winds small and variable for several days the vapours, instead of dispersing, must have been rising and constantly collecting in the air, until the atmosphere became highly charged with an uncommon quantity of them.

Огромное количество паров, собранных таким образом в атмосфере к 19-му мая, оказались недалеко от поверхности земли. Удельный вес паров меньше, чем удельный вес воздуха, поэтому испарения поднимались вверх. Если удельный вес паров, в атмосфере, больше, чем воздуха, такой пар будет опускаться к земле: а если удельный вес паров и воздуха совпадают, то пар будет находиться в состоянии покоя, — перемещаясь в атмосфере, без подъема вверх или опускания вниз. Из барометрических наблюдений ясно, что вес или тяжесть атмосферы 19 мая постепенно увеличивался с утра и до вечера. А значит и пар, в большинстве мест, спускался от верхней части атмосферы, к поверхности земли. Из отчета, сделанного в Пепперрелли, следует, что в некоторых местах испарения поднимались вверх, пока не достигли высоты, где пар и воздух имели одинаковый удельный вес; и где они равно-

мерно распространялись в воздухе, и парили в атмосфере: – и эта высота была не намного выше соседних холмов. Из этих наблюдений, мы приходим к выводу о том, что в тех местах, где пары были сбалансированы, и имели такой же удельный вес, как и воздух, они должны были располагаться очень близко к поверхности земли.

A large quantity of the vapours, thus collected in the atmosphere, on the 19th of May, were floating near the surface of the earth. Whosoever the specific gravity of any vapour is less than the specific gravity of the air, by the laws of fluids, such a vapour will ascend in the air. Where the specific gravity of a vapour, in the atmosphere, is greater than that of the air, such a vapour will descend: and where the specific gravity of the vapour and air are the same, the vapour will then be at rest, – floating or swimming in the atmosphere, without ascending or descending. From the barometrical observations it appears, that the weight or gravity of the atmosphere was gradually growing less, from the morning of the 19th of May, until the evening. And hence the vapours, in most places, were descending from the higher parts of the atmosphere, towards the surface of the earth. From the observation made at Pepperrell, it appears, that in some places the vapours were ascending, until they arose to an height in which the air was of the same specific gravity; where they instantly spread, and floated in the atmosphere: – and this height was not much above the adjacent hills. From these observations, we are lead to conclude, that the place where the vapours were balanced, or became of the same specific gravity as the air, must have been very near the surface of the earth. And hence we may observe,

Поэтому мы могли наблюдать такое большое количество пара, плавающего в атмосфере вблизи поверхности земли, и этого было достаточно, чтобы произвести {242} все явления, которые наблюдались 19 мая 1780 года. Поэтому направление, из которого должна появиться тьма, зависит от направления ветра, как и было отмечено при появлении темноты с юго-западной стороны. Насыщенность темноты зависит от плотности, цвета и положения облаков и тумана, и от того, каким образом они будут пропускать, отражать, преломлять или поглощать лучи света. Выраженность темноты будет зависеть, в том числе, и от количества пара. Темнота будет продолжаться до тех пор, пока плотность воздуха не изменится, и когда пар начнет менять свое положение, путем подъема вверх или опускания вниз. Все эти объяснения, как я думаю, полностью совпадают с отчетами, которые были упомянуты. Влияние паров на освещенность предметов, находящихся вблизи к поверхности земли, было более выраженным, чем наблюдавшееся затемнение солнца и луны, поскольку их положение было выше атмосферы.

That such a large quantity of vapour, floating in the atmosphere, near the surface of the earth, might be sufficient to produce {242} all the phenomena that were observed May 19, 1780. Thus the direction in which the darkness came on, would be determined by the direction of the wind, which accordingly was observed to be from the S. W. The degree of the darkness would depend on the density, colour, and situation of the clouds and vapour; and the manner in which they would transmit, reflect, refract, or absorb the rays of light. The extent of the darkness would be as great as the extent of the vapour: and the duration of it would continue until the gravity of the air became so altered, that the vapours would change their situation, by an ascent or descent. All which particulars will, I think, be found to agree very exactly with the observations that have been mentioned. Nor does the effect of the vapours, in darkening terrestrial objects, when they lay near the surface of the earth, appeal to have been greater than it was in darkening the sun and moon, when their situation was higher in the atmosphere.

В целом, очевидно, что атмосфера в большой степени была насыщена парами, и эти пары были разной плотности, и занимали разную высоту. А это означает, что солнечные лучи, падающие на них, в определенной степени должно были претерпевать преломление и отражение, и тем самым становится более слабыми; поглоща-

ясь, или отражаясь, они не достигали объектов на земле, как это происходило в другое время. Поскольку разные испарения, в зависимости от их плотности, могут по-разному поглощать или пропускать различные виды лучей, поэтому кажущийся цвет предметов определяется смесью и преобладанием тех лучей, которые прошли через столь необычную полупрозрачную среду {243}.

Upon the whole, it is evident, that the atmosphere was charged, in a high degree, with vapours; and that these vapours were of different densities, and occupied different heights. By this mean the rays of light falling upon them, must have suffered a variety of refractions and reflections; and thereby become weakened, absorbed, or so far reflected, as not to fall upon objects on the earth in the usual manner. And as the different vapours were adapted by their nature, situation, or density, to absorb, or transmit, the different kind of rays, so the colours of objects would appear to be affected by the mixture and prevalency of those rays that were transmitted through so uncommon a medium {243}.

Во всем этом отчете, я старался объяснить то, что я считаю причиной возникновения необычной темноты. Тем не менее, я не стал бы утверждать, что не может быть каких-либо других причин или обстоятельств, которые могли бы присоединиться, чтобы произвести этот необычное явление. Возможно, там могли быть причины и обстоятельства такого характера, о которых мы не имеем никакого представления. Но, поскольку, необычное количество и положения паров в атмосфере было достаточным для того, чтобы вызвать описываемое явление, поэтому я не вижу большой необходимости искать другие причины, или переходить к рассмотрению различных гипотез, которые выдвигались для объяснения этого явления.

In what has been said, I have endeavoured to explain what I take to be the cause of the late unusual darkness. I would not, however, be understood to assert, that there could not be any other causes or circumstances which might join to produce this unusual appearance. Possibly there might be causes and circumstances of this nature, of which we have no suspicion. But as the uncommon quantity and situation of the vapours in the atmosphere might be sufficient to account for the phenomena, it appears to me to be unnecessary to look out for other causes, or to go into a particular examination of the various conjectures that have been advanced upon this subject.

Возможно, не лишним будет заметить, что подобные явления, вызванные аналогичной причиной, уже наблюдались ранее в этой части Америки. В Философских записках [Philosoph. Trans.], № 423, опубликован отчет о необычной темноте, которая наблюдалась 21 октября 1716 года. Там говорится, что: "*в тот день было так темно, что люди были вынуждены во время обеда зажигать свечи. И это не было связано с затмением, поскольку солнечное затмение уже было 4-го октября*". Этот доклад сделал господин Роби (Robie), человек большой изобретательности, и бывший преподаватель университета, но там ничего не сказано о причине явления или о каких либо других деталях.* Несколько человек сообщили мне, что они помнят необычную тьму в августе 1732 года, которая впоследствии была объяснена необычными пожарами в Канаде. Было бы хорошо найти что-то более конкретное на эту тему.

* An Abstract of Meteorological Diaries communicated to the Royal Society, with Remarks on them by W. Derham, D.D. Canon of Windsor, and F.R.S. – Philosophical Transactions, 1731, V 37, Jan 1, N 423: 261-273 {добавл. МТ}.

It may not be amiss to observe, that such appearances, and from the same cause, have been observed before, in this part of America. In the Philosophical Transactions, N°- 423, there is an account of a remarkable darkness, which took place October 21, 1716, O.S. It is said, "The day was so dark, that people were forced to light candles to eat their dinners by. "Which could not be from any eclipse, the solar eclipse being the 4th of that month." This observation was made by Mr. Robie, a man of great ingenuity, and formerly a Tutor in the University: but there is nothing said as to the cause, or any other particulars. Several persons have informed me, that they remember an uncommon darkness in the year 1732, Augusts O.S. and which was afterwards found to be occasioned by an uncommon fire in Canada. It is to be wished, that we could find something more particular upon this subject.

Имеется также описание необычной темноты имевшей место в Детройте, 19 октября 1762 года, очень похожей на ту, которая наблюдалась 19 мая (1780), и о которой имеется отчет преподобного Джеймса Стирлинга, опубликованный в Философских записках за 1763 год, том. LIII (53): 63: "В прошлый вторник, т.е. 19-го октября {244} наступило почти полное затмение, продолжавшееся в течение большей части дня. Я проснулся утром. Примерно через десять минут после того я отметил, что рассвет не наступал. Такая же темнота продолжалась до девяти часов, когда наметилось небольшое прояснение. Затем, примерно в течение четверти часа, мы наблюдали круг солнца, который имел красный цвет, напоминающий кровь, но круг был более чем в три раза, больше, чем обычно. Все это время воздух был очень плотный, грязно желтоватого цвета. В час дня мне пришлось зажечь свечи, чтобы подготовить все к обеду, хотя стол находился рядом с двумя большими окнами. Около трех часов дня, темнота стала еще более выраженной, и далее она усиливалась до половины четвертого; в течение этого времени ветер дул с юго-западного направления, принося капли дождя, серы и грязи; по запаху и по другим свойствам, падающие капли содержали больше грязи и серы, чем воды. Я взял чистой лист бумаги и вынес его на открытый воздух; и капли дождя, падающие на лист бумаги, оставляли на нем черные пятна; после экспозиции листа бумаги рядом с огнем, чернота превратилась в желтый цвет; после сжигания бумаги остался влажный пепел. Во время этого дождя воздух был насыщен сильным удушливым запахом серы. – После дождя наблюдалось небольшое прояснение.

There was also a remarkable darkness at Detroit, October 19, 1762, much like that of May 19; of which we have this account, by the Rev. James Stirling, Phil. Trans. for 1763, vol. liii. p. 63. "Tuesday last, being the 19th inst. (i. e. of {244} October) we had almost total darkness for the most of the day. I got up at day break. About ten minutes after, I observed it got no lighter than before. The same darkness continued until nine o'clock, when it cleared up a little. We then, for the space of about a quarter of an hour, saw the body of the sun, which appeared as red as blood, and more than three times as large as usual. The air, all this time, which was very dense, was of a dirty yellowish colour. I was obliged to light candles to see to dine, at one o'clock, notwithstanding the table was placed close by two large windows. About three, the darkness became more horrible; which augmented until half past three, when the wind breezed up from the S. W. and brought on some drops of rain, or rather sulphur, and dirt; for it appeared more like the latter than the former, both in smell and quality. I took a leaf of clean paper, and held it out in the rain, which rendered it black whenever the drops fell upon it; but, when held near the fire, turned to a yellow colour; and when burned, it fizzed on the paper like wet powder. During this shower, the air was almost suffocating with a strong sulphureous smell. – It cleared up a little after the rain.

Существуют различные предположения о причинах этого природного явления. Индейцы, а также простолюдины среди французов, говорили, что англичане, кото-

рые прибыли на лодках со стороны Ниагары совсем недавно, привезли с собой чуму. Другое предположение – это связь темноты с горением леса: но мне кажется, что наиболее вероятной причиной могло быть последствием извержения какого-то вулкана или подземного огня, в результате чего сернистый дым, поднялся в воздух и находится там до тех пор, пока не перемешался с {245} парами воды, и упал вниз вместе с дождем.*

There were various conjectures about the cause of this natural incident. The Indians, and vulgar among the French, said, that the English, which lately arrived from Niagara in the vessel, had brought the plague with them. Others imagined, it might have been occasioned by the burning of the woods: but I think it most probable, that it might have been occasioned by the eruption of some volcano, or subterraneous fire, whereby the sulphureous matter may have been emitted in the air, and contained therein, until, meeting with some {245} watery clouds, it has fallen down together with the rain.

Этот же случай описан в письме одного офицера, который тогда был в Детройте, навещая своего друга в Уилмингтоне (Wilmington), в штате Пенсильвания. "19-го этого месяца (октябрь 1762), был самый необычный темный день, возможно, когда-либо произошедший в истории мира. В девять часов утра, количество света было меньше, чем при обычном рассвете, и так продолжалось до двенадцати часов дня, – в воздухе было много дыма с соответствующим сильным запахом, как при горении дерева, соломы и других горючих веществ. Полчаса спустя было по-прежнему темно, поэтому мы были вынуждены зажигать свечи, чтобы принять еду. В это время был небольшой дождь, вместе с которым на землю упало определенное количество черных частиц, похожих на пепел, и все предметы, на которые они падали, окрасились в черный цвет. Даже река (которая в два раза шире, чем Кристиана (Christiania) в Пенсильвании) была покрыта черной пеной; которая плавала на поверхности воды, и напоминала пену от хозяйственного мыла, с той лишь разницей, что эта пена (черная, как чернила) была более насыщенной. В семь часов вечера воздух стал более чистым, и неприятный запах почти исчез. Нам также рассказывали другие очевидцы, находящиеся за двадцать миль отсюда, что в тот самый день, темнота, дождь, и запах, были такие же, как у нас".

We have another account of this phenomena, in a letter from an officer, who was then at *Detroit*, to a friend at *Wilmington*; in *Pennsylvania*. "The 19th of this month, (October, 1762) was the most extraordinary dark day, perhaps, ever seen in the world. At nine in the morning, it was scarce lighter than at break of day, and so continued till about twelve o'clock, – the air being very full of smoke, accompanied with a strong smell, as of wood, straw, and other combustibles, when burning. At half an hour after one it was so dark that we were obliged to light candles to dine by. At this time it rained a little; with which fell a quantity of black particles, like ashes, as turned every thing it fell upon black. Even the river (which is twice as wide as *Christiania* in *Pennsylvania*) was covered with black froth; which, when scummed off the surface, resembled the lather of soap, with this difference, that it was (and as black as ink) more greasy. At seven in the evening, the air was more clear, and the disagreeable smell was now almost gone. We have since been informed, by people who were twenty miles from hence that day, that the darkness, rain, and smell, was the same with them.

* An Account of a remarkable Darkness at Detroit, in America: In a Letter from the Rev. Mr. James Stirling, to Mr. John Duncan: communicated by Samuel Mead, Esq; F. R. C. - Philosophical Transactions, 1764, V 53, For the Year 1763: 63-64 {ссылка добавлена МТ}.

Как мне кажется, нет никакого основания в пользу гипотезы об извержении вулкана, или подземных пожаров, или сернистых веществ. С учетом всех известных подробностей, природные явления, описываемые нами, были вызваны одной и той же причиной".

There does not appear to have been any thing to support the conjecture of a volcano, *subterraneous fires*, and *sulphureous matter*. In all other particulars, the phenomena agree to those that were observed among us, and seem to be derived from the same cause.

*"Счастлив тот, кто смог познать причину вещей,
и поверг под ноги все страхи и неумолимую судьбу..."**

*Felix, qui potuit rerum cognoscere causas,
Atque metus omnes et inexorabile satum.
Subjecit pedibus. {246}.*

* * *



Портрет Самуила Уильямса (Williams, 1743-1817) и его могила.[†]

* Вергилий, "Георгики", II, 490-492 {ссылка добавлена МТ}.

† Rev Samuel Williams. In:Find a Grave.<http://www.findagrave.com/cgi-bin/fq.cgi?page=gr&GRid=35429148>

M E M O I R S
O F T H E
A M E R I C A N A C A D E M Y
O F
A R T S
A N D
S C I E N C E S :

T O T H E E N D O F T H E Y E A R M,D C C ,LXXXIIL

VOLUME I.



B O S T O N :
P R I N T E D B Y A D A M S A N D N O U R S E , I N C O U R T - S T R E E T .
M,D C C ,LXXXV.

IV. *An Account of a very uncommon Darkness in the States of New-England, May 19, 1780. By SAMUEL WILLIAMS; A. M. Hollis Professor of Mathematics and Philosophy in the University at Cambridge.*

THE best method to promote the knowledge and science of nature, is to proceed by way of observation and experiment. The general course, productions, and laws of nature, should be carefully and steadily attended to : and when any new phenomena appear, all the circumstances and effects, relating to them, should be particularly noted and collected. In this way we shall be most likely to arrive at the knowledge of their causes : or, at least, we shall prepare those materials which may enable posterity to determine, with certainty and precision, on what at present may be but imperfectly understood.

With this view, I shall endeavour to lay before the Society, as particular an account as I can collect, of the uncommon darkness which took place in the states of *New-England*.

The *time* of this extraordinary darkness, was May 19, 1780. It came on between the hours of ten and eleven, A. M. and continued until the middle of the next night ; but with different appearances at different places. As to the *manner* of its approach it seemed to appear first of all in the S. W. The wind came from that quarter, and the darkness appeared to come on with the clouds that came in that direction. The *degree* to which the darkness arose, was different in different places. In most parts of the country it was so great, that people were unable to read common print—determine the time of day by their clocks,

clocks or watches—dine—or manage their domestic business, without the light of candles. In some places, the darkness was so great, that persons could not see to read common print in the open air, for several hours together: but I believe this was not generally the case. The *extent* of this darkness was very remarkable. Our intelligence, in this respect, is not so particular as I could wish: but from the accounts that have been received, it seems to have extended all over the *New-England* states. It was observed as far east as *Falmouth*.—To the westward, we hear of its reaching to the furthest parts of *Connecticut*, and *Albany*.—To the southward, it was observed all along the sea-coasts:—and to the north, as far as our settlements extend. It is probable it extended much beyond these limits, in some directions: but the exact boundaries cannot be ascertained by any observations that I have been able to collect. With regard to its *duration*, it continued in this place at least fourteen hours: but it is probable this was not exactly the same in different parts of the country. The *appearance* and *effects* were such as tended to make the prospect extremely dull and gloomy. Candles were lighted up in the houses;—the birds having sung their evening songs, disappeared, and became silent;—the fowls retired to roost;—the cocks were crowing all around, as at break of day;—objects could not be distinguished but at a very little distance; and every thing bore the appearance and gloom of night.

Such were the general appearances or phenomena of this extraordinary darkness. I shall now mention such particular observations as I have been able to collect, which were either made on this phenomenon, or seem to relate to it.

With regard to the state of the atmosphere preceding this uncommon darkness, it was universally observed for several days before, that the air appeared to be full of smoke and vapour. The sun and the moon appeared remarkably red in their colour, and divested of their brightness and lucid appearance: and this obscuration increased as they approached nearer to the horizon. This was observed to be the case in almost all parts of the *New-England* states, for four or five days preceding the 19th of May. The winds had been variable; but chiefly from the S. W. and N. E. The thermometer from 40° to 55° . The barometer rather high for this part of *America*,—from 29 inches 80, to 30 inches 50. The weather had been fair and cool for the season.

As to the state of the atmosphere when the darkness came on, it was observable, that the weight or gravity of it was gradually decreasing the bigger part of the day. This may be inferred from the observations that were made in this place by the Rev. Professor *Wigglesworth*, and Mr. *Gannett*. At 12^{h} they found the mercury in the barometer stood at 29 inches 70. At $12^{\text{h}} 30'$, the mercury had fallen the $\frac{1}{100}$ part of an inch. At 1^{h} it was at 29 inches 67. At 3^{h} it was at 29 inches 65. At $8^{\text{h}} 8'$ it was at 29 inches 64. I made a course of barometrical observations similar to these, at the same time, in a different part of the state. I was then at *Bradford*, about thirty miles north of this place, nearly under the same meridian, or rather a little to the east. At 6^{h} A. M. I found the mercury in the barometer 29 inches 82. As soon as the darkness began to appear uncommon, I observed the barometer again, and found the mercury at 29 inches 68: this was at $10^{\text{h}} 20'$. At $10^{\text{h}} 45'$, the darkness arose to its greatest degree in that part of the country; and the mercury was then at 29. inches 67. The darkness

ness continued in the same degree for an hour and an half. At 12^h. 15', the mercury had fallen to 29 inches 65 ; and in a few minutes after this, the darkness began to abate. The mercury remained in this state until evening, without any sensible alteration. At 8^h. 30', it seemed to have fallen a little ; but so small was the alteration, that it was attended with some uncertainty ; nor could I perceive that it stood any lower at 11^h. 30'.

Both these barometers appear to be very good instruments. That used in this place was made by *Champney* : that which I used was made by *Nairne* : and they may both be depended on as to the accuracy of their construction. It may, however, be proper to observe, that the house where I made my observations, stood at least forty or fifty feet higher than that in which the observations were made here..

And from these observations it is certain, that on the day when the darkness took place, the weight or gravity of the atmosphere was gradually decreasing through the whole day.*

The colour of objects that day, was also worthy of remark. It is mentioned, in the observations made by the gentlemen here, that "the complexion of the clouds was compounded of a faint red, yellow, and brown : and that, during the darkness, objects, which commonly appear green, were of the deepest green, verging to blue ; and that those which appear white, were highly tinged with yellow." Much the same observation was pretty generally made. Almost every object appeared to me to be tinged with yellow rather than with any other

* Farenheit's thermometer, at Bradford, at 6^h. A. M. was at 39°. At 12^h, it stood at 51°. At 9^h. P. M. it was at 46°.—At Cambridge, at 12^h. it was at 51 $\frac{1}{2}$ °. At 3^h. P. M. it stood at 51°.

other colour. This I found to be the case with every thing I held up to view, whether near, or remote from the eye.

Another thing that deserves our attention is, the nature and appearance of the vapours that were then in the atmosphere. Early in the morning, the weather was cloudy : the sun was but just visible through the clouds, and appeared of a deep red, as it had for several days before. In most places thunder was heard several times in the morning. The clouds soon began to rise from the S. W. with a gentle breeze ; and there were several small showers before eight o'clock : and in some places there were showers at other times, throughout the day. The water that fell was found to have an uncommon appearance, being thick, dark and sooty. A gentleman, who was then at *Ipswich*, observes, that " he found the people much surprized with the strange appearance and smell of the rain-water which they had saved in tubs. Upon examining the water, I found (says he) a light scum over it, which rubbing between my thumb and finger, I found to be nothing but the black ashes of burnt leaves : the water gave the same strong sooty smell which we had observed in the air." The same appearance was observed in many other places : and it was very remarkable on *Merrimack-River*. Large quantities of scum, or black ashes, were found floating upon the surface of the water, that day. In the night, the wind veered round to the N. E. and drove it towards the south shore. When the tide fell, it lay along the shore at the width of four or five inches. This I found to be the case for five or six miles ;—and probably it was the case for many more. I examined a considerable quantity of this matter ; and in taste, colour and smell, it very plainly appeared to be nothing more than what the gentleman observed at *Ipswich*,

wich,—the black ashes of burnt leaves, without any sulphureous, or other mixtures.*

Being apprehensive whether there was not some uncommon matter in the air that day, I put out several sheets of clean paper in the air and rain. When they had been out four or five hours, I dried them by the fire. They were much sullied, and became dark in their colour ; and felt as if they had been rubbed with oil or grease. But upon burning them, there was not any appearance of sulphureous or nitrous particles.

The motion and situation of the vapours in the atmosphere, was also worthy of notice. In most places it was very evident that the vapours were descending from the higher parts of the atmosphere towards the surface of the earth. A gentleman, who was then at *Pepperrell*,† mentions a very curious observation, as to their *ascent* and *situation*. “ About nine o’clock (says he) in the morning, after a shower, the vapours rose from the springs in the low lands, in great abundance. I took notice of one large column that ascended with great rapidity, to a considerable height above the highest hills, and soon spread into a large cloud ; then moved off a little to the westward. A second cloud was formed in the same manner, from the same springs, but did not ascend so high as the first : and a third was formed from the same places, in less than a quarter of an hour after the second. About three quarters of an hour after nine o’clock, these clouds exhibited a very romantic appearance. The upper cloud appeared of a *reddish* colour : the second ap-peared,

* The same was observed at *Concord* and *Dover* in *New-Hampshire* : at *Berwick*, and many other places in this state.

† *Mr. Eames*, a Tutor in the University.

peared, in some places, green; in others, blue; and in others of an *indigo* colour: the third cloud appeared almost white." One of the gentlemen who observed here, mentions a circumstance of somewhat a singular nature.—" While the darkness continued (says he) the clouds were in quick motion, interrupted, skirted one over another; so as apparently, and I suppose, really, to form a considerable number of *strata*: the lower *stratum* of an uniform height as far as visible;—that height conceived to be very small from the small extent of the visible horizon, and from this circumstance observed in the evening:— Being in the street, I saw a person with a lighted torch, which occasioned a reflection of a faint red light, similar to a faint Aurora Borealis, at a small height above my head. The height at which the reflection appeared to be made, was not more than from twenty to thirty feet."—And it was generally remarked, that the hills might be seen at a distance in some directions, while the intermediate spaces were greatly obscured and darkened.

From these observations, it seems as if the vapours, in some places, were ascending; in most, descending; and in all, very near to the surface of the earth. To this we may add, that during the darkness, objects appeared to cast a shade in every direction: and that, in many places, there were several appearances or coruscations in the atmosphere, not unlike the *Aurora Borealis*: but I do not find that there were any uncommon appearances of the electric fire any where observed that day.*

Having

* In several accounts it was also mentioned, that a number of small birds were found suffocated by the vapour. " A number were found dead in several of the new towns, round the houses; and some flew into the houses, as I have been told by eye-witnesses." Extract of a letter from *Dover*, in *New-Hampshire*.

Having mentioned the phenomena, with such observations upon them, as I have been able to collect, I shall now endeavour to account for the cause of this unusual appearance.

From the observations that have been mentioned, we may conclude with much certainty, that the atmosphere, on the 19th of May, was charged with an uncommon quantity of vapour. That this was the case, is evident from the large quantity of smoke and vapour that appeared in the atmosphere for several days before ; which was so great, as to darken the sun and moon, and render all objects, at a distance, of a dull and very hazy appearance. It was also evident, from the descent of those large quantities of soot, or black ashes, which, through a long extent of country, were found mingled with the rain that fell, and floating on the surface of the waters. And the cause from whence the uncommon quantity of these vapours was derived, is easily ascertained. It is well known, that in this part of *America*, it is customary to make large fires in the woods, for the purpose of clearing the lands in the new settlements. This was the case this spring, in a much greater degree than is common. In the county of *York*, in the western parts of the state of *New-Hampshire*, in the western parts of this state, and in *Vermont*, uncommonly large and extensive fires had been kept up. The people in the new towns had been employed in clearing up their lands this way, for two or three weeks before : and some large and extensive fires had raged in the woods for several days before they could be extinguished. In addition, therefore, to what arises from evaporation, and those exhalations which are constant and natural, a much larger quantity of vapour arose from those large and numerous fires, which extended all around our frontiers. As the weather had been clear, the

air heavy, and the winds small and variable for several days; the vapours, instead of dispersing, must have been rising and constantly collecting in the air, until the atmosphere became highly charged with an uncommon quantity of them.

A large quantity of the vapours, thus collected in the atmosphere, on the 19th of May, were floating near the surface of the earth. Wheresoever the specific gravity of any vapour is less than the specific gravity of the air, by the laws of fluids, such a vapour will ascend in the air. Where the specific gravity of a vapour, in the atmosphere, is greater than that of the air, such a vapour will descend: and where the specific gravity of the vapour and air are the same, the vapour will then be at rest,—floating or swimming in the atmosphere, without ascending or descending. From the barometrical observations it appears, that the weight or gravity of the atmosphere was gradually growing less, from the morning of the 19th of May, until the evening. And hence the vapours, in most places, were descending from the higher parts of the atmosphere, towards the surface of the earth. From the observation made at *Pepperrell*, it appears, that in some places the vapours were ascending, until they arose to an height in which the air was of the same specific gravity; where they instantly spread, and floated in the atmosphere:—and this height was not much above the adjacent hills. From these observations, we are lead to conclude, that the place where the vapours were balanced, or became of the same specific gravity as the air, must have been very near the surface of the earth. And hence we may observe,

That such a large quantity of vapour, floating in the atmosphere, near the surface of the earth, might be sufficient to produce

duce all the phenomena that were observed May 19, 1780.— Thus the *direction* in which the darkness came on, would be determined by the direction of the wind ; which accordingly was observed to be from the S. W. The *degree* of the darkness would depend on the density, colour, and situation of the clouds and vapour ; and the manner in which they would transmit, reflect, refract, or absorb the rays of light. The *extent* of the darkness would be as great as the extent of the vapour : and the *duration* of it would continue until the gravity of the air became so altered, that the vapours would change their situation, by an ascent or descent. All which particulars will, I think, be found to agree very exactly with the observations that have been mentioned. Nor does the *effect* of the vapours, in darkening terrestrial objects, when they lay near the surface of the earth, appear to have been greater than it was in darkening the sun and moon, when their situation was higher in the atmosphere.

Upon the whole, it is evident, that the atmosphere was charged, in a high degree, with vapours ; and that these vapours were of different densities, and occupied different heights. By this means the rays of light falling upon them, must have suffered a variety of refractions and reflections ; and thereby become weakened, absorbed, or so far reflected, as not to fall upon objects on the earth in the usual manner. And as the different vapours were adapted by their nature, situation, or density, to absorb, or transmit, the different kind of rays, so the colours of objects would appear to be affected by the mixture and prevalency of those rays that were transmitted through so uncommon a medium.

In what has been said, I have endeavoured to explain what I take to be the cause of the late unusual darkness. I would not, however, be understood to assert, that there could not be any other causes or circumstances which might join to produce this unusual appearance. Possibly there might be causes and circumstances of this nature, of which we have no suspicion. But as the uncommon quantity and situation of the vapours in the atmosphere might be sufficient to account for the phenomena, it appears to me to be unnecessary to look out for other causes, or to go into a particular examination of the various conjectures that have been advanced upon this subject.

It may not be amiss to observe, that such appearances, and from the same cause, have been observed before, in this part of *America*. In the Philosophical Transactions, No. 423, there is an account of a remarkable darkness, which took place October 21, 1716, O. S. It is said, "The day was so dark, that people were forced to light candles to eat their dinners by. Which could not be from any eclipse, the solar eclipse being the 4th of that month." This observation was made by Mr. *Robie*, a man of great ingenuity, and formerly a Tutor in the University : but there is nothing said as to the cause, or any other particulars. Several persons have informed me, that they remember an uncommon darkness in the year 1732, August 9, O. S. and which was afterwards found to be occasioned by an uncommon fire in *Canada*. It is to be wished, that we could find something more particular upon this subject.

There was also a remarkable darkness at *Detroit*, October 19, 1762, much like that of May 19 ; of which we have this account, by the Rev. *James Stirling*, Phil. Transl. for 1763, vol. liii. p. 63. "Tuesday last, being the 19th inst. (i. e. of

"October)

" October) we had almost total darkness for the most of the
" day. I got up at day break. About ten minutes after, I ob-
" served it got no lighter than before. The same darkness con-
" tinued until nine o'clock, when it cleared up a little. We
" then, for the space of about a quarter of an hour, saw the
" body of the sun, which appeared as red as blood, and more
" than three times as large as usual. The air, all this time,
" which was very dense, was of a dirty yellowish colour. I
" was obliged to light candles to see to dine, at one o'clock,
" notwithstanding the table was placed close by two large win-
" dows. About three, the darkness became more horrible ;
" which augmented until half past three, when the wind breez-
" ed up from the S. W. and brought on some drops of rain,
" or rather sulphur, and dirt ; for it appeared more like the
" latter than the former, both in smell and quality. I took a
" leaf of clean paper, and held it out in the rain, which ren-
" dered it black whenever the drops fell upon it ; but, when
" held near the fire, turned to a yellow colour ; and when
" burned, it fizzed on the paper like wet powder. During this
" shower, the air was almost suffocating with a strong sulphu-
" reous smell.—It cleared up a little after the rain.

" There were various conjectures about the cause of this na-
" tural incident. The *Indians*, and vulgar among the *French*,
" said, that the *English*, which lately arrived from *Niagara* in
" the vessel, had brought the plague with them. Others ima-
" gined, it might have been occasioned by the burning of the
" woods : but I think it most probable, that it might have
" been occasioned by the eruption of some volcano, or subter-
" raneous fire, whereby the sulphureous matter may have been
" emitted in the air, and contained therein, until, meeting with
" some

" some watery clouds, it has fallen down together with the
" rain."

We have another account of this phenomena, in a letter from an officer, who was then at *Detroit*, to a friend at *Wilmington*, in *Pennsylvania*. " The 19th of this month, (October, 1762) was the most extraordinary dark day, perhaps, ever seen in the world. At nine in the morning, it was scarce lighter than at break of day, and so continued till about twelve o'clock,—the air being very full of smoke, accompanied with a strong smell, as of wood, straw, and other combustibles, when burning. At half an hour after one, it was so dark that we were obliged to light candles to dine by. At this time it rained a little; with which fell a quantity of black particles, like ashes, as turned every thing it fell upon black. Even the river (which is twice as wide as *Christiane* in *Pennsylvania*) was covered with black froth; which, when scummed off the surface, resembled the lather of soap, with this difference, that it was (and as black as ink) more greasy. At seven in the evening, the air was more clear, and the disagreeable smell was now almost gone. We have since been informed, by people who were twenty miles from hence that day, that the darkness, rain, and smell, was the same with them."

There does not appear to have been any thing to support the conjecture of a *volcano*, *subterraneous fires*, and *sulphureous matter*. In all other particulars, the phenomena agree to those that were observed among us, and seem to be derived from the same cause.

Felix, qui potuit rerum cognoscere causas,
Atque metus omnes et inexorabile fatum
Subjecit pedibus.—